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(पहला पुनरीक्षण)

Electric Chain Hoists — Specification

(First Revision)

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Cranes, Lifting Chains and Its Related Equipment Sectional Committee, MED 14

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Cranes Lifting Chains and Its Related Equipment Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published in 1972. This revision has been undertaken to incorporate changes based on the experience gained in the implementation of the Indian Standard.

In the preparation of this standard, considerable assistance has been derived from the following publications:

> AS B273-1968 'Specification for chain blocks, power operated', Standards Association of Australia.
>
> AS CB2-1960 'SAA Code for cranes and hoists', Standards Association of Australia.
>
> HMA 400 — 'Electric chain hoists', Hoist Manufacturers Association, USA.
>
> ASME HST-1-1999 (reaffirmed 2004) 'Performance standard for electric chain hoists', American Society of Mechanical Engineers.

This standard is in general agreement with the applicable requirements of IS 3938 : 1983 'Specification for electric wire rope hoists'.

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard
ELECTRIC CHAIN HOISTS — SPECIFICATION
(First Revision)

SECTION 1 GENERAL

1 SCOPE

1.1 This standard covers the design, manufacture, testing and operation of all industrial service electric chain hoists of the following types:

a) Lug suspended (*see* Fig.1),
b) Hook suspended (*see* Fig. 2), and
c) Trolley suspended (*see* Fig. 3) – Three types of trolley suspended– push pull type, hand geared type and motor operated type (*see* Fig. 3A).

1.1.1 This standard also lays down the minimum requirements to ensure safety.

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of the standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Electric Chain Hoist — An electro-mechanical appliance whose principal function is lifting or lowering or both of loads with a calibrated short link or roller chain between the sheave and the lifting block.

3.2 Capacity or Safe Working Load — The maximum safe working load in kgs / tonnes that the hoist is designed to carry in service. This shall be specified by the manufacturer of the hoist and marked boldly and clearly on the hoist and hook block. Applied loads shall include all handling devices used, such as buckets, magnets and grabs.

3.3 Basic and Permissible Stress — All permissible stresses specified in IS 800, IS 816 and IS 1024 are basic stresses for the purpose of this standard, and the permissible stresses in this standard are basic stresses applied with the applicable duty factor (*see* **6.2**).

3.4 Height of Lift — The distance between the upper most and lowest limits of travel of the hook block.

3.5 Hoisting Speed — The velocity in m/min at which the hoist will lift the rated load.

3.6 Head Room — Measured with the hook block in the highest position with full load, and it is the distance between the saddle of the hook block and the following points:

a) The top of the lug or centre line of suspension holes on lug suspended hoists,
b) The saddle of the top hook on hook suspended hoists, and
c) The bottom of the beam or rail on trolley suspended hoists.

3.7 Lug Suspended Hoist — A hoist whose upper suspension members are lugs.

3.8 Hook Suspended Hoist — A hoist whose upper suspension member is a hook.

3.9 Trolley — A wheeled carriage from which the hoist is suspended. The trolley may be push pull type, hand-operated or motor-operated type.

3.10 Trolley Suspended Hoist — A hoist whose upper suspension member is a trolley for the purpose of travel on a suitable runway.

3.11 Electric Dynamic Brake — An electric motor acting as a brake by regenerative counter torque or dynamic means.

3.12 Electrically Operated Brake — A friction brake actuated or controlled by electric / electromagnetic means.

3.13 Limit Switch — A device to cut off the power to motor automatically at both ends of hook path or at any desired limit of travel.

3.14 Electrical Characteristics — Clearly specified electrical characteristics consisting of voltage, phases, cycles if a.c. power is used, and voltage only if d.c. power is used.

3.15 Load Sprocket — A hoist component that transmits motion to the load chain. This component is also called load chain wheel.

3.16 Idler Sprocket — A freely rotating device that changes the direction of the load chain. This device is also called idler wheel, idler sheave, pocket wheel or chain wheel.

3.17 Hook Block or Load Block — The assembly of lower load hook or shackle, swivel, bearing, pins, sprocket and frame suspended by the load chain.

3.18 Load Chain — The load lifting chain in the hoist. It shall be a calibrated short link chain as per IS/ISO 3077 or a calibrated roller chain when in agreement with the user.

3.19 Reeving — A system in which a chain travels around sprockets.

3.20 Pendant Station — Electrical controls station with push button suspended from the hoist for operating the unit.

4 CAPACITY, HOISTING SPEED AND LIFTING HEIGHT

4.1 Industrial electric chain hoists shall be rated according to capacities as follows:

> 0.25, 0.5, 1.00, 2.0, 3.2, 5.0, 6.3, 7.5, 10, 15 and 20 MT

However, higher capacity electric chain hoist can be supplied in agreement with the user.

4.2 Hoisting speeds may range from 1 m/min to 20 m/min depending on the application, usage and manufacturer's design. Higher speeds can be offered on mutual agreement between the manufacturer and the buyer. The actual lifting speed shall be within ±2 percent of the manufacturer's rating. Chain hoists may be designed to offer either single or dual hoisting speed with the use of dual speed motor and control. In special applications VVF / Inverter drives with programmable step may be used to achieve dual hoisting speed or variable hoisting speed. Tolerance is not applicable for creep speed.

5 CLASSIFICATION

The hoists shall be classified in three group of mechanism with respect to the estimate of use, frequency of application and variation of magnitude of the load (*see* Table 1) and the effect of impact [*see* Table 1 and IS 13834 (Part 1)].

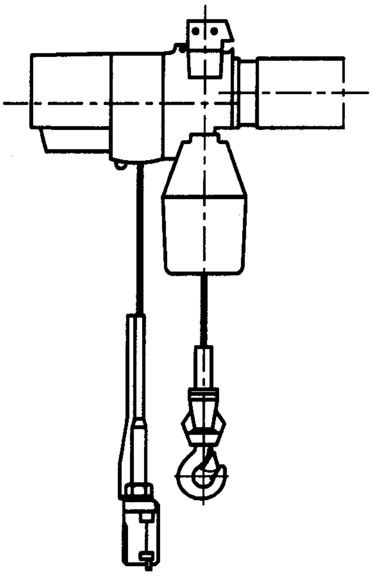


FIG. 1 LUG SUSPENDED ELECTRIC CHAIN HOIST

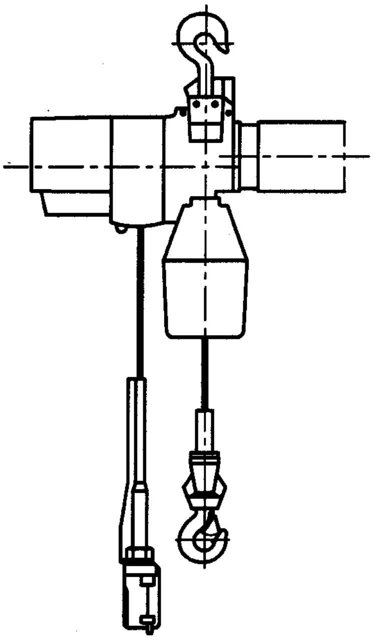


FIG. 2 HOOK SUSPENDED ELECTRIC CHAIN HOIST

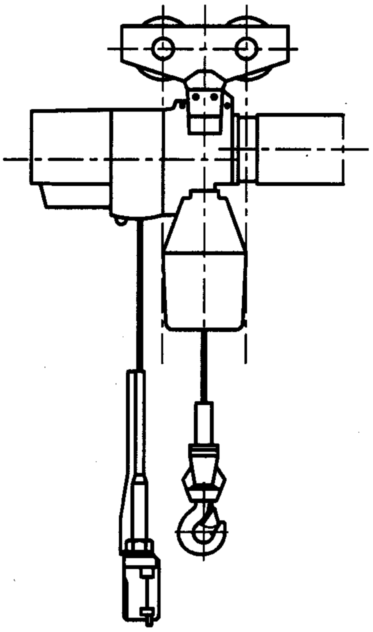
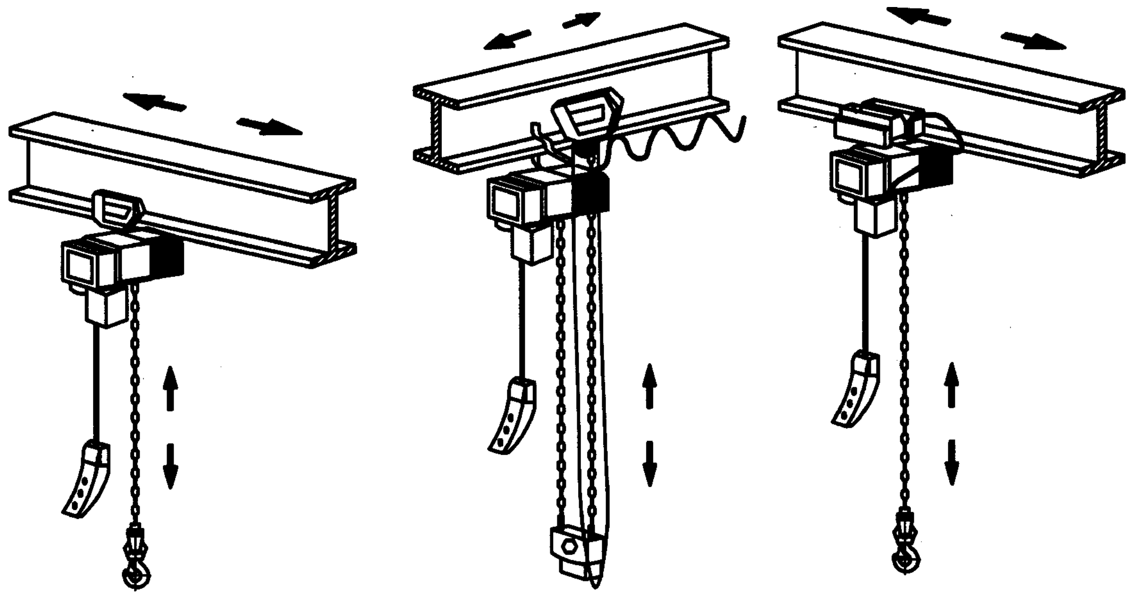


FIG. 3 TROLLEY SUSPENDED ELECTRIC CHAIN HOIST



PUSH PULL TROLLEY ELECTRIC CHAIN HOIST

HAND OPERATED TROLLEY ELECTRIC CHAIN HOIST

MOTOR OPERATED TROLLEY ELECTRIC CHAIN HOIST

FIG. 3A TYPES OF TROLLEY SUSPENDED ELECTRIC CHAIN HOIST

SECTION 2 MECHANICAL REQUIREMENTS

6 DESIGN AND FABRICATION

6.1 General

The materials used in the construction of hoists shall be properly selected for the stresses encountered when the equipment is used in accordance with the manufacturer's recommendations. The design of the component parts of the hoist shall include due allowance for the effects of the duty which the mechanism will perform in service and shall be in accordance with the requirements of **6.2** and **6.3**.

6.2 Design on Strength Basis

In the design of a component on the basis of ultimate strength, the value of the stress factor used shall be the basic stress factor multiplied by the duty factor for the appropriate hoist class; where basic stress factor shall be not less than 5 and the duty factor shall be as given in Table 1 for the respective mechanism. Normally the electric chain hoists are designed to offer M3, M5 and M6.

6.3 Design on Life Basis

Components designed on the basis of life shall have a rated life of not less than 10 years of 250 days per year for Class M3 300 days per year for Class M5, and 333 days per year for Class M6.

Table 1 Duty Factor and Life of Mechanism

(*Clauses* 5, 6.2, 6.3.1, 8.1 and 8.3.3)

Sl No.	Mechanism Class as per IS 13834 (Part 1)	Duty Factor		Maximum Running hours per day	Total Life h
		Strength	Wear		
(1)	(2)	(3)	(4)	(5)	(6)
i)	M3	1.06	0.4	1.0	3 200
ii)	M5	1.25	0.5	1.5	6 300
iii)	M6	1.32	0.6	3.0	12 500

6.3.1 The running hours per day or the life in hours used for the purpose of the design of the components shall be the value specified in Table 1 for the appropriate class.

6.4 Design on Dynamic Load Basis

Power transmission parts shall be designed so that the dynamic stresses calculated for the rated load shall not exceed the fatigue and endurance limit of the material used.

6.5 Welding

Steel parts may be joined by any fusion-welding process provided the welding is in accordance with the relevant Indian Standard. The design shall be such that the maximum permissible stresses in the welds shall not exceed those given in IS 807 and IS 1024.

6.6 Bolts and Nuts

All bolts and nuts shall comply with the relevant Indian Standard.

6.6.1 Bolts in tensions shall be avoided wherever possible. Black bolts shall not be used for transmitting lifting loads. Bolts and set screws in rotating parts shall be locked.

6.7 Keys and Keyways

Keys and keyways shall be as per IS 2048. Keys shall be so fitted or secured that they cannot work loose.

7 LOAD CHAIN AND ACCESSORIES

7.1 Load Chain and Chain Anchorages

7.1.1 Load chain shall be Grade T or higher made of alloy steel, machine calibrated, heat treated and proof tested short link chain as per IS/ISO 3077 or other equivalent International Standard so that the finished hoist chain complies with mechanical properties.

7.1.2 On special approval from customer alloy steel, heat treated machine calibrated roller chain may be used.

7.1.3 Chain shall be accurately pitched, calibrated and heat treated.

7.1.4 If a load is supported by more than one part of load chain, the tension of the part shall be equalized.

7.1.5 The load chain anchorages, associated fittings and frames both at the lifting end and at the slack end shall be at least equal in strength subject to factors to the general design of the block.

7.1.6 Roller chain anchorages shall be articulated.

7.2 Chain Wheels

7.2.1 *Material*

The load chain drive wheel shall be of 45C8 of IS 2004 or alloy steel material and heat treated to adequate strength suitable for use with the load chain employed.

7.2.2 *Design*

The design of the load chain wheel drive shall be such that, so as to ensure effective operation with the load chain. The load chain wheel shall have pockets accurately machined or shaped to fit the links of the Grade T of IS/ISO 3077 load chain which shall operate freely and smoothly over the load wheel and without causing damage to the chain. Minimum number of pockets on the load wheel shall be four. Sprocket type wheels for roller chain shall be machined or shaped from alloy steel heat treated material.

7.2.3 *Chain Guide*

Enclosed chain guides shall be provided to ensure that the hoist load chain enters the sprocket in the proper position to prevent misalignment or jamming of the hoist load chain and chain wheel. These guides (if bolted) shall have means to prevent loosening under vibration.

7.2.3.1 Where roller guides are used, the edges of their centre groove shall be radiused or chamfered to prevent damage to the load chain.

7.2.4 *Chain Stripper*

A chain stripper may be provided for binding of the chain with the sprocket while unwinding or entering.

7.2.5 *Chain Collector/Containers*

Chain shall be freely suspended and where necessary a chain collector shall be fitted. The chain collector shall be so designed as to permit the chain to enter the chain block in a manner that will not damage the chain or chain block and allow smooth flow out of the container. The chain container shall be made of processed canvas or steel.

7.3 Idler Wheel

7.3.1 *Material*

The idler/drive wheels shall be of C_{45} or $C_{55}Mn_{75}$ or E_8 material of adequate strength suitable for use with the load chain employed.

7.3.2 *Design*

Where the design of the idler wheel provides for more than four pockets, the wheel shall have accurately pitched pockets for the reception of the load chain. Idler wheels in bottom assemblies shall be fitted with guards to prevent injury to persons handling the hook block whilst the chain block is in use.

7.3.3 *Chain Guides*

The idler wheel shall be provided with chain guides so shaped as to prevent the chain from twisting or leaving the wheel when passing round the wheel.

7.4 Hooks and Hook Fittings

7.4.1 *Hooks*

Hooks shall be made of closed die, alloy steel forged or conforming to relevant Indian Standards. All hooks shall be equipped with latches. All hooks shall be proof tested to 200 percent of safe working load.

7.4.1.1 Where the hook is supplied with a nut, the nut shall be held securely by a pin of diameter not less than one-quarter of the nominal thread diameter with a minimum of 2.5 mm.

7.4.1.2 The length of shank engaged by the nut on the load side shall be not less than 75 percent of the nominal diameter of the thread before pinning and the outside diameter of the bearing surface of the nut shall be not less than 1.4 times the nominal diameter of the thread.

7.4.1.3 All suspension assemblies which are not readily detachable for inspection for wear of parts, particularly hook shanks, shall be designed to permit the amount of wear to be measured by alternative means.

7.4.1.4 Every hook and hook block shall be permanently marked with its safe working load provided that its safe working load does not exceed that marked on the chain block.

7.4.2 *Crossheads*

Unless otherwise approved, hook crosshead shall be of a single-piece steel construction.

7.4.3 *Trunnions*

Trunnions shall project through the cheek plates of the blocks by not less than 3 mm and shall incorporate means for preventing the spreading of cheek plates. Where a trunnion is of the oscillating type adequate bearing surfaces shall be provided.

7.5 Hook Swivels

7.5.1 *Top Hook*

Where the top hook is required to swivel, it shall be fitted with plain bearings which may incorporate friction washers. Ball or roller bearing may also be used with friction washers.

7.5.2 *Bottom Hook*

The bottom hook shall be so designed that it shall be free to swivel in the loaded conditions without twisting the load chain. Hooks shall be equipped with safety latches.

8 TRANSMISSION DEVICES AND ANCILLARIES

8.1 Bearings

Bearing shall be selected for the load spectrum factor and corresponding total life in accordance with IS 13834 (Part 1) (*see* Table 1).

8.1.1 *Permissible Types*

All running shafts and wheels running on fixed axles or pins shall be fitted with ball, roller anti-friction bearings unless otherwise specified.

8.1.2 *Design*

Due allowance shall be made for impact and side thrusts and where necessary, spherical seatings and separate thrust bearing of suitable dimensions shall be used.

8.1.2.1 Ball and roller bearings shall conform to the dimensions specified in IS 5669.

8.1.3 *Lubrication of Bearings*

Provision shall be made for lubrication of all moving parts and bearings, while the hoist is in service except where life-lubricated bearings are used. Ball and roller bearings shall, in addition, be lubricated before assembly. Lubricating nipples and adapters shall be easily accessible and shall generally comply with the relevant Indian Standards. All exposed bearings shall be suitably sealed or shielded.

8.1.3.1 Lubrication arrangements shall be such as to require infrequent attention.

8.2 Shafts

8.2.1 *General*

Shafts shall be designed for the load spectrum factor and corresponding total duration in hours in accordance with IS 13834 (Part 1).

8.2.2 *Material*

All shafts shall be made of steel of minimum grade 45C8 of IS 1570 or alloy steel as per IS 4367 or higher.

8.2.3 *Shaft Keys*

Where practicable, keys and keyways and splines shall conform to the relevant Indian Standards.

8.3 Gears

8.3.1 *Types*

The gears used in the electric chain hoist shall be machined and hardened as per IS 4460.

8.3.2 *Material*

All gears shall be of steel of minimum grade C_{45} or En_8 as per IS 1570.

8.3.3 *Design*

Gears shall be designed for proper strength and surface durability in accordance with the appropriate class of mechanism as per IS 13834 (Part 1) using the duty factor given in Table 1 as minimum for the appropriate class of mechanism.

8.3.4 *Keying*

Keys and keyways in gear trains shall comply with the relevant Indian Standard and shall be so fitted and secured that they cannot work loose in service.

8.3.5 *Lubrication*

All hoist gearing shall be enclosed and either sealed life lubricated or provided with means for ample lubrication.

8.4 Overload Clutch/Friction Clutch

Overload slipping clutch mechanism (torque limiter) for limiting the torque may be provided in the gear train to safe guard the chain hoist against inadvertent overloading or over traveling of the hook. The load limiter shall be set between safe working load (SWL) and 125 percent of safe working load.

8.5 Brakes

8.5.1 *General*

Every electric chain hoist shall be fitted with a magnetic cone brake/clutch brake.

8.5.1.1 Provision shall be made to control with safety the lowering of any load up to and including the test load.

8.5.1.2 Suitable provision shall be made for holding the load in the event of the stoppage of the motor or failure of the current power supply.

8.5.1.3 The operating control arrangements shall be such that the brakes cannot be released accidentally or inadvertently.

8.5.2 *Capacity of Brakes*

The brake, when applied, shall arrest the motion and sustain any load up to and including the test load at any position of the lift. The brakes shall be capable of exerting a restraining torque 50 percent greater than the torque transmitted to the brake drum from the suspended test load, the friction in the transmission mechanics between the load and the brake not being taken into consideration.

8.5.3 *Brake Components*

8.5.3.1 *Brake disk/Brake drums and shoes*

The wearing surface of all brake drums liner shall be machined. It shall be smooth and free from defects. Brake lining shall be effectively and permanently secured to the brake shoes during the effective life of the lining. It shall be protected from water, grease, oil or other adverse effects. Under service conditions, the temperature of the rubbing surfaces shall not exceed above 260°C with metal lining.

8.5.3.2 *Springs*

Springs for electro-mechanical brakes shall be of the compression type and shall not be stressed in excess of 80 percent of the torsional elastic limit of the material.

8.5.3.3 *Weights*

Brake weights, if provided, shall be securely bolted to their levers and locked.

8.6 Ratchet Wheels and Pawls

Manufacturer if provides hoist with ratchet wheel and pawl as an additional safety feature, the same shall be made of steel and be capable of sustaining a load 25 percent above the maximum safe working load of the hoist. All ratchet teeth shall be sharp with sufficient under-cut to prevent inadvertent disengagement of the pawl.

9 TROLLEYS

9.1 Types

Trolleys shall be push pull type, hand-operated type or motor operated type (*see* Fig. 3A).

9.2 Gears

Hand-operated trolley track wheels may have gears with cast, machined or pressed teeth.

9.2.1 Hand chain of size 5 or 6 mm of minimum 30 Grade, calibrated, similar to IS/ISO 3077 may be used.

9.2.2 Hand chain wheel of hand geared trolley shall be guarded to prevent hand chain disengagement from the hand wheel.

9.2.3 Hand chain shall withstand, without permanent distortion a force of three times the pull required to traverse the trolley with rated load.

9.3 Brakes

The electric driven trolley shall be provided with a brake.

SECTION 3 ELECTRICAL CHARACTERISTICS

10 GENERAL

It is necessary that the following precautions are observed in installation and operation of electrical equipment of the electric chain hoist so that safety in operation is ensured:

a) The power voltage used on a hoist shall be within 415 V ± 10 percent;

b) All motors, controllers and switch frames shall be earthed;

c) All electric equipment shall be thoroughly protected from dirt, grease and oil and, where exposed to the weather, shall be thoroughly protected against the weather;

d) Guards for live parts shall be substantial and so located that the cannot be deformed so as to make contact with the live parts;

e) Control voltage shall not exceed 110V a.c.; and

f) Name plates shall be fixed in such a manner that it is difficult to remove them.

11 MOTORS

11.1 Rating and Enclosure

The rating shall be such that, under the specified service condition, the temperature-rise does not exceed the limits specified in IS 325 for three-phase induction motors or other relevant Indian Standard. This shall not preclude the use of intermittent motors, if required.

11.1.1 User shall specify the voltage, frequency and phase alongwith tolerance of the power supply available.

11.1.2 The hoist manufacturer shall assume 40°C ambient temperature unless otherwise specified by the user.

11.1.3 Rating of motor shall be selected (CDF) depending on the frequency of operation, the height of lift and application.

11.1.4 Maximum speed of rotation of the motor shall be limited to 1 440 rpm. User approval shall be obtained for higher rpm of motor.

11.1.5 The enclosure shall suit the specified working conditions and shall be stipulated with enquiry or order. It can be IP55.

11.2 Torque

The pull-out torque of any motor supplied at rated voltage should preferably be not less than 2.25 times the rated torque.

11.3 Design and Construction

Motors shall be of high starting torque, crane duty and suitable for frequent reversal, braking and acceleration.

11.4 Mounting

Motors shall be so located that the brush gear and terminals are accessible for inspection and maintenance, and do not restrict the normal ventilation.

11.5 Limiting Speeds

Limiting speeds for motors should not exceed those specified by the motor manufacturer.

11.6 Terminals

Motor leads shall be brought out from the motor frame to terminals in the terminal box fixed to the motor frame.

12 PENDANT CONTROL SWITCH

12.1 General

Hoist shall be designated so that remote control may be affected by means of a push-button pendant switch and automatically causes the brakes to function. Pendant control switches shall be adequately protected to prevent accidental contact with live parts.

12.2 Operation

Push-button pendant control shall be electrically operated. Fully magnetic reversing type contactors shall be provided for the hoist and shall be operated by a momentary contact type push-button station. The push-buttons shall return to “off” position when pressure is released by the operator. A separate button or a single button providing steps for each speed of multispeed hoists shall be provided. The magnetic contactor shall be mechanically or electrically interlocked. The push buttons can control a VVF/Inverter drive directly without using contactors.

12.3 Accessibility

All controllers shall be so disposed that the contacts and terminal arrangements are readily accessible for inspection and maintenance purposes.

12.4 Pendant Push-Button Control Switch

The pendant switch shall be capable of withstanding rough handling without being damaged and the cover shall be effectively secured.

12.5 Suspension of Pendant Switch

The weight of the pendant shall be supported independent of the electric cable by means of chain or wire rope. If the pendant is of metal, it shall be effectively earthed. A chain or hook does not provide an effective earth connection and should not be relied upon for that purpose.

12.6 The push-button station shall be clearly marked as follows to indicate the function of each button. Push-button control voltage shall be exceed 110 V for ac. Voltage of 250 V is permissible on d.c. or special applications.

MOTION	MARKING ON THE PUSH BUTTON	
UP	↑	ON
DOWN	↓	OFF
UP	↑	EMERGENCY
DOWN	↓	
LEFT	←	
Right	→	

13 CONTROLS

13.1 Control Circuits

If the main supply is a.c. and the control circuits are supplied at reduced voltage, the supply to these circuits shall be from the secondary winding of an isolating transformer or an isolating transformer and rectifier. One pole of this supply shall be earthed and the contactor and relay coils shall he connected to this pole; or other equally effective means shall be adopted to prevent malfunctioning owing to sneak circuits or earth faults.

13.2 Controls for d.c. Supply

When a d.c. control circuit is so designed that the motor acts as generator in the lowering direction, the control shall be such that:

a) with maximum load on the hook, the motor may not exceed predetermined maximum rev/min;
b) progressive degrees of braking are provided in the various steps of the controller;
c) adequate light hook lowering speeds are provided;
d) arrangements are made to prevent the brake from being released by the back emf of the motor when the power supply has been interrupted; and
e) the electro-mechanical brake is automatically applied when the circuit-breaker of contactor attached to the hoist is opened.

13.2.1 All controls of a hoist shall be so arranged that no motion is inadvertently started when the power is supplied for an interruption.

14 BRAKING

The braking may be electric (electro-dynamic), electro-hydraulic or electro-mechanical. Brake can be of shoe or disc type depending upon purchaser's requirement.

14.1 In addition to the specific requirements of this standard in regard to the provision of brakes and irrespective of the supply current, frictional clutch braking is permissible on all electric chain hoists.

14.1.1 When electric braking is used provision shall be made to limit the current on reversal to a safe value. Effective means shall be provided for stopping the motion in the event of a power failure and in the case of an emergency.

14.2 Electro-Hydraulic Braking

Use of electro-hydraulic thrust operated brake is also permissible on special application on request from the user.

14.3 Electro-Mechanical Braking

The electro-mechanical brake(s) used, shall apply automatically when power supply fails or when the controller handle is brought to the 'off' position.

14.4 Brake Magnets

The terminals of brake magnets shall be protected from accidental contact and the connections and windings shall be effectively protected from mechanical damage. When necessary, magnets shall be provided with an efficient cushioning device. Two duties are recognized for both a.c. and d.c., namely:

a) continuous or heavy duty; and
b) normal intermittent duty.

14.4.1 Since, with an a.c. brake magnet, the current in the coil is greater for the open position than when closed, the ratings for ac are slightly different from d.c. as shown in Table 2.

14.4.2 The brake magnets shall operate, for both operations at the current and voltage given in Table 3.

14.5 Brake Release

Appropriate mechanical, electro-hydraulic or any other alternative brake releasing gears may be used instead of brake magnets, if desired on specific user request.

15 LIMIT SWITCHES

15.1 Limit switch shall be of shunt type and shall permit the motor to be operated in the reverse direction when the limit switch is opened. Those incorporating a spring to provide quick breaking of the contacts shall be so designed and constructed that failure of the spring does not affect positive opening of the contacts.

Table 2 Brake Magnet Ratings

(*Clause* 14.4.1)

Sl No. (1)	Duty (2)	d.c. Magnet (3)	a.c. Magnets (4)
i)	Heavy duty	Suitable for being in circuit not more than 7.5 minutes out of every 15 min or 240 operations per hour	Suitable for being in circuit continuously where the brake coil operates infrequently or For 240 operations per hour where the brake coil is in circuit is not more than 5 min out of every 15 min
ii)	Normal duty	Suitable for 240 operations per hour where the brake coil is in circuit is not more than 5 min out of every 15 min	Suitable for 120 operation per hour where the brake coil is in circuit is not more than 5 min of every 15 min

Table 3 Brake Magnet Operating Current and Voltages

(*Clause* 14.4.2)

Winding (1)	d.c. Magnets (2)	a.c. Magnets (3)
For series resistor control	Lift at 60 percent rated current	—
Shunt	Hold at 15 percent rated current	—
	Lift1) at 90 percent rated voltage	Lift at 90 percent rated voltage
	Hold1) at 50 percent rated voltage	Hold at 50 percent rated voltage

1) This is intended to apply with coils at temperature corresponding to the duty cycle at rated volts. The temperature-rise of the brake magnet shall not exceed that allowed for the control equipment fitted.

NOTE — Arrangements shall be made, where necessary, to prevent the brake magnet from being energized by the back emf of the motor when the supply has been interrupted.

15.1.1 Limit switches shall be of the series or shunt type and shall permit the motor to be operated in the reverse direction when the limit switch is opened. The limit switch after being tripped shall automatically reset itself within a reasonable distance travelled in the opposite direction. This does not prevent the use of the changeover type limit switches, where the resetting is achieved by striker when moving in the opposite direction.

15.2 Hoist Limit Switch

When the hook has risen to a predetermined level, this limit switch shall act and prevent over-hoisting and consequential damage arising there from to the hook or hook block, chain and mechanical equipment. The design and adjustment of over-hoisting limit switch shall be such that after opening of the switch under condition of maximum hoisting speed and no load:

a) there shall be an over-run which measured in metres shall not be more than 1/40 of the maximum speed in m/min; and

b) after cessation of motion, there shall be not less than 100 mm of available movement of the hook.

15.3 Limit Switch for Lowering

This shall be fitted to prevent over-lowering.

15.4 Hoisting and lowering limit switches shall be automatically reset when the hook is returned to the normal operating zone.

16 ELECTRICAL PROTECTIVE DEVICES

16.1 Contactor Circuit-Breaker Operated

As minimum equipment of protection, an electro-magnetically operated contactor with inherent under voltage protection together with overload devices shall be provided.

16.1.1 The overload protection may be of the electro-magnetic type, with time delay or thermal overload relays in conjunction with high rupturing capacity fuses.

16.1.2 The number of overload devices and their position shall normally be in accordance with one of the arrangements shown in Table 4 but if specified by the purchaser, other arrangements giving protection of not less than any of these shall be considered as complying with this standard.

Table 4 Normal Requirements for Number of Protective Devices for Motor Circuits

(*Clause* 16.1.2)

d.c. supply	Three-Phase a.c. supply
Neither line earthed	One line earthed
One in each line	Three lines shall be protected

16.2 Phase Sequence Relay

If applicable, phase sequence relay shall be provided in the control panel to prevent wrong connection.

16.3 Over voltage, over current and earth leakage safety accessories shall be provided in the control panel.

16.4 Remote Control/Pendant Control Station

If emergency switch is pressed it should directly trip main line contractor, which should be essential part of hoist panel along with other usual switchgear items.

17 CABLES AND CONDUCTORS

17.1 Cables

Rubber, PVC or varnished cambric insulated cables used for hoist wiring shall comply with the relevant Indian Standard. All cables shall be adequately protected against mechanical damage and from damage by weather. When metal conduits or flexible tubes are used, their ends shall be screwed adequately, to prevent ingress or moisture.

17.2 Minimum Size of Cables

Cables having conductors, complying with the relevant Indian Standard, smaller than 2.5 mm^2 nominal equivalent copper area of cross-section shall not be used for the power wiring to the motor. For control circuits and auxiliary wiring, cables having a sectional area smaller than 1.5 mm^2 nominal equivalent copper area shall not be used.

17.3 Multicore Armoured Cables

Multicore armoured power and control cables suitably clamped may be used to avoid conduits and troughings. Suitable clamping glands should be provided at both ends of each multicore cable.

17.4 Outdoor Hoist Wiring

For outdoor hoists, except where flexible unarmoured cables are essential, cables shall be either armoured or enclosed throughout their length in galvanized trunking or conduit, either flexible or rigid. A flexible metallic tube or duct may not form an effective earth connection and shall not be used for that purpose. Taped, braided or varnished-cambric insulated cables shall not be used for outdoor hoists.

17.5 Current Rating

Rating of the cables shall comply with the relevant Indian Standard. Where hoists are equipped with 1h rated motor, the cables shall be up-rated by a factor of 1.4 above the ratings for continuous duty. Similarly, for hoists equipped with half-an-hour rated motors an up-rating factor of 1.7 may be used. Where the hoists are equipped with intermittent duty rated motors the factor for up-rating the cable is equal to $10/\sqrt{(\text{IDF})}$, where IDF is the intermittent duty factor.

17.5.1 Rotor or armature resistor circuit cables carry current during accelerating periods only and, therefore, may be still further up-rated. For 10 min and 5 min rated resistors, the uprating factors of 1.5 and 2 may be used.

17.5.2 Consideration should be given to such factors as the ambient temperature, grouping and disposition of the cables, and to the limitation of voltage drop which influences selection of suitable cables.

18 EARTHING

18.1 The hoist structure, motor frames and metal cases of all electrical equipment, including metal conduit or cable guards, shall be effectively connected to earth.

18.2 Where the hoist is connected to the supply by flexible cord or flexible cable, the hoist shall be connected to earth by means of an earthing conductor enclosed with the current carrying conductors within the flexible cord or flexible cable.

19 GUARDS

19.1 Where there is any possibility of any person coming in contact with an exposed part of an electrical circuit, other than one operating at extra low voltage, such part shall be effectively guarded.

19.2 All reciprocating and moving parts which might constitute a hazard shall be guarded.

19.3 All guards shall be securely fastened so that vibration shall not loosen them.

SECTION 4 TESTS, CERTIFICATE OF TEST AND COMPLIANCE

20 TESTS AT MANUFACTURER'S WORKS

20.1 All electrical and mechanical equipment shall be tested in accordance with the appropriate Indian Standards at the hoist or equipment maker's works.

20.2 A functional test to determine how well the hoist works and tests on motors and control equipment to determine the operating characteristics shall be conducted.

20.2.1 The hoist shall be tested at manufacturer's works at no load, full load and 125 percent of the safe working load.

20.2.2 *Brakes*

The brakes shall be capable of holding 50 percent in excess of safe working load when the load is suspended by the work.

20.2.3 *Safety Devices*

Test for the effectiveness of the automatic device to limit the upward and downward travel of the hook.

20.3 Insulation Tests

Before the hoist is connected to the supply, the insulation of the electrical equipment shall be tested by a suitable instrument and any defect revealed shall be rectified.

20.3.1 The voltage required for the insulation resistance test shall be at d.c. voltage not less than twice the rated voltage.

20.3.2 Any reading less than 0.5 MΩ obtained with an insulation resistance tester of the unregulated type shall be disregarded and the wiring under test shall be sub-divided until a reading higher than 0.5 MΩ is obtained. Failure to obtain a higher reading shows an unsatisfactory state of the insulation.

NOTE — A reading below 0.5 MΩ obtained with such a tester may indicate that unduly low proportion of the prescribed test voltage is in fact being applied.

20.3.2.1 If an installation has been subdivided for test purposes, each sub-division shall meet the requirements.

20.3.3 The insulation resistance of each wiring circuit, exclusive of connected apparatus, shall be not less than 2 MΩ. If necessary, it shall be permissible to disconnect individual items of equipment while making this test.

20.3.4 *Tests for Operation*

After the supply has been connected, and before the hoist is put into commercial service, tests shall be carried out to prove the following:

a) The satisfactory operation of each controller, switch, contactor, relay and other control devices and in particular the correct operation of all limit switches under the most unfavourable conditions;
b) The correctness of all circuits and interlocks and sequence of operation; and
c) The satisfactory operation of all protective safety devices.

20.4 Overload Tests

20.4.1 After tests but before the hoist is put into service, it shall be tested with overload relays appropriately set to lift and sustain a test load of 125 percent of the working load.

20.4.2 During the overload test, the hoist shall sustain the load under full control. The specified speeds need not be attained but the hoist shall show itself capable of dealing with the overload without difficulty.

NOTE — Test load and necessary lifting tackle shall be provided by the purchaser for load test at user site.

20.5 Any test required by the purchaser beyond those called for in the appropriate Indian Standard shall be subjected to mutual agreement and shall be carried out at the purchaser's expense.

21 CERTIFICATE OF COMPLIANCE

21.1 Test Certificates

A certified record of the test figures including the speed of the lift for safe working load shall be supplied to the purchaser and recorded on the test certificate which shall also indicate whether the electric chain hoist complies with the standard, if required by the purchaser.

NOTE — The requirement that the contract speeds of lifting shall be attained is contingent on the voltage and frequency of the electricity supply to the motor being correctly maintained.

SECTION 5 MARKING AND SUPPLY

22 CONDITIONS

Unless otherwise required by the purchaser, every hoist shall be given at least one priming and one finishing coat of paint. Prior to painting, the metal work shall be thoroughly cleaned, dried and shall be free from welding slag, rust, oil and grease. Metal surfaces bolted or riveted together shall be primed before assembly. Paint may be applied by spray gun or brush or by dipping.

23 MARKING

23.1 Capacity Marking

The rated load of each hoist in kgs / tonnes shall be marked plainly on the hoist and load block, so as to be clearly legible from the floor below the hoist.

23.2 A name plate containing the following information shall be provided on the hoist at a prominent place:

a) Manufacturer's name, trade-mark or identification;
b) Type or model number; serial number and year of manufacture; and
c) SWL capacity.

23.3 BIS Certification Marking

The electric chain hoists may also be marked with the Standard Mark.

23.3.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

24 DATA TO BE SUPPLIED BY THE MANUFACTURER ALONGWITH THE HOIST

24.1 Test Certificate

A certified record of the test report shall be supplied to the purchaser with the hoist.

24.2 Installation, Maintenance and Operational Instructions

Each hoist shall be provided with instruction sheets containing full information on the method of installation, operation and electrical wiring of the hoist and components. Each hoist shall be provided with a manual containing maintenance instructions and information regarding ordering replacement parts.

24.3 Wiring Diagram

A wiring diagram of the hoist shall be supplied with each hoist. The technical document shall give the rating of the motor; the cable sizes and such other information as will tend to facilitate inspection and maintenance of the hoist. In case of contactor controlled hoists, a schematic diagram shall be supplied.

25 INFORMATION TO BE SUPPLIED WITH THE ENQUIRY OR ORDER

25.1 Number of hoists required.

25.2 A brief description of the work to be accomplished including the number of lifts per hour or day.

25.3 Capacity in tonnes.

25.4 Type of suspension:

a) Lug;
b) Hook;
c) Manual push trolley;
d) Manual geared trolley;
e) Motor driven trolley; and
f) Base mounted.

25.5 Head Room

Maximum head room dimension permissible.

25.6 Maximum Lift in metres

The distance between the upper and lower limits of travel of the load block.

25.7 Desired hoisting and trolley travel speed in m/min.

25.8 Method of Operation

Pendant push-button or pendant rope.

25.9 Speed Control

a) *Hoist* — single speed, two speed or variable speed.
b) *Trolley* — single speed, hand-operated or motor-operated.

25.10 Type of Hook Required

25.11 Operating Current

a) a.c. — voltage, phases, cycles and number of wires.
b) d.c. — voltage.

25.12 Beam or rail size for trolley mounted hoists-height, width, weight per metre and minimum radius in track.

25.13 Special condition to be explained (if any), like heat, dust, moisture, hazardous atmosphere, etc, explain fully.

25.14 Statutory requirements applicable.

25.15 Compliance with this standard.

26 INFORMATION TO BE SUPPLIED BY MANUFACTURER

26.1 Description of unit.

26.2 Type and class of hoist.

26.3 Safe working load.

26.4 Motor. ……..kW at ………….. min, rating.

26.5 Operating power supply:

a) a.c. — voltage, phases, cycles and number of wires.
b) d.c. — voltage.

26.6 Head room.

26.7 Type of suspension.

26.8 Maximum lift in metres

26.9 Speed control — single speed, two speed, or variable speed.

26.10 Hoisting speed:

a) If trolley supplied — type of trolley:
    1) Hand operated.
    2) Motor operated.
b) If motor operated — speed, m/min.

26.11 Methods of Operation

Pendant push-button or pendant rope.

26.12 Number of brakes — types.

26.13 Chain — size in mm, type — roller or link, grade, number of falls, and minimum breaking load.

26.14 Beam or rail size for trolley mounted hoists and minimum radius of track

26.15 Net weight.

26.16 Statement to the effect that the hoist conforms to this standard.

26.17 Tools and accessories supplied.

26.18 Drawing of general arrangement, electrical circuit diagram and spare parts list.

26.19 Any special features.

ANNEX A

(*Clause 2*)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
325 : 1996	Specification for three-phase induction motors (*third revision*)
800 : 2007	General construction in steel — Code of practice (*third revision*)
807 : 2006	Design, erection and testing (structural portion) of cranes and hoists — Code of practice (*second revision*)
816 : 1969	Code of practice for use of metal arc welding for general construction in mild steel (*first revision*)
1024 : 1999	Code of practice for use of welding in bridges and structures subject to dynamic loading (*second revision*)
2004 : 1991	Carbon steel forgings for general engineering purpose (*third revision*)
2048 : 1983	Parallel keys and keyways (*second revision*)
3938 : 1983	Specification for electric wire rope hoists (*second revision*)
13834 (Part 1) : 1994 / ISO 4301-1 : 1986	Cranes — Classification : Part 1 General
IS/ISO 3077 : 2001	Short link chain for lifting purposes — Grade T (Types T, DAT and DT), fine-tolerance hoist chain
4367 : 1991	Alloy steel forgings for general industrial use (*first revision*)
4460 (Parts 1 to 3) : 1995	Gears — Spur and helical gears — Calculation of load capacity (*first revision*)
5669 : 1987 / ISO 15 : 1981	General plan of boundary dimensions for radial rolling bearings

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Cranes Lifting Chains and Related Equipment Sectional Committee, MED 14

Organization	*Representative(s)*
BEML Limited, Kolar Gold Field	Shri Ramesh Desai (***Chairman***)
ABB Limited, Bangalore	Shri Prakash Rao Shri M. S. Prasad (*Alternate*)
Alstom Industrial Products Limited, Kolkata	Shri A. K. Sengupta Shri Rajiv Ranjan (*Alternate*)
Anupam Industries Limited, Vitthal Udyognagar	Shri P. Jha Shri S. K. Mitra (*Alternate*)
Armsel MHE Private Limited, Bangalore	Shri A. C. Heri Shri Preet H. Heri (*Alternate*)
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Bharat Heavy Electricals Limited, Tiruchirapalli	Shri P. Nainar Shri M. Dharmalingam (*Alternate*)
Brady and Morris Engineering Company Limited, Ahmedabad	Shri S. Gowrisankar Shri J. B. Bhatt (*Alternate*)
Central Building Research Institute, Ahmedabad	Shri R. S. Bisht Shri Narendra Kumar (*Alternate*)
Demelec Technical Con, Nasik	Shri Dhruba Mallik Shrimati Madhurima Mallik (*Alternate*)
Directorate General Factory Advice Service and Labour, Mumbai	Shri U. K. Das Shri H. Chattopadhyay (*Alternate*)
Electrosteel Integrated Limited, Kolkata	Shri A. K. Sadhukhan
Furnace and Foundry Equipment Company, Mumbai	Shri Shyam M. Gurnani Shri Sanjoy J. Masand (*Alternate*)
Heavy Engineering Corporation Limited, Ranchi	Shri Madan Jha Shri M. M. Prasad (*Alternate*)
Hercules Hoists Limited, Mumbai	Shri A. R. Masurkar Shri M. S. Saigal (*Alternate*)
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Indian Chain Private Limited, Kolkata	Shri P. Chitlangia Shri Lalit Mohan (*Alternate*)
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M.N. Dastur and Company Limited, Kolkata	Shri Debabrata Ray Shri Anshuman Bhandari (*Alternate*)
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Mega Drives Private Limited, Thane	Shri Deepak Majumdar Shri S. Chakraborty (*Alternate*)
Ministry of Defence (DGQA), Ahmednagar	Shri K. Sudhakaran Shri Raghubir Singh (*Alternate*)
Ministry of Road Transport and Highways, New Delhi	Shri K. C. Sharma
Ministry of Shipping, New Delhi	Shri A. R. Rao Shri D. J. Basu (*Alternate*)
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Mukand Limited, Thane	Shri T. Muralidhar Shri G. V. Prabhu (*Alternate*)

Organization	*Representative(s)*
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The Indian Link Chain Manufacturers Limited, Mumbai	SHRI P. K. NEVATIA
TIL Limited, Kolkata	SHRI SRIMANTA DATTA SHRI A. CHAKRABORTY (*Alternate*)
Unicon Tech International (Private) Limited, New Delhi	SHRI R. S. NALWA SHRI SACHIN NALWA (*Alternate*)
Unique Industrial Handlers Private Limited, Mumbai	SHRI G. L. MIRCHANDANI SHRI S. E. BADLAWALA (*Alternate*)
WMI Cranes Limited, Mumbai	SHRI S. M. MALANI SHRI D. CHATTERJI (*Alternate*)
In personnel capacity (*42/D4 Kesava Nagar, Opposite Anna Stadium, Trichy)*	SHRI K. MANICKAM
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Member Secretary
SHRI M. K. PARAMANIK
Scientist C (MED), BIS

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Amendments Issued Since Publication

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